FCC CFR47 PART 90 CERTIFICATION

TEST REPORT

FOR

Restaurant Wireless Data Management System (Main Unit)
(457.575MHz TRANSCEIVER)

MODEL: HWM-WC1000

FCC ID: ODGWWC1000

REPORT NUMBER: 01I0892-1

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1. VARIFICATION OF THE COMPLIANCE

COMPANY NAME: **HANTEL CO. LTD.**
KOREA

CONTACT PERSON: **HOE-BUM KIM**

TELPHONE NO: **(2) 571-4653**

EUT DESCRIPTION: **Restaurant Wireless Data Management System Main Unit**

MODEL NAME: **HWM-WC1000**

DATE TESTED: **02/23/02 – 02/28/02 & 07/03/02**

TYPE OF EQUIPMENT	INTENTIONAL RADIATOR
EQUIPMENT TYPE	457.575MHz TRANSCEIVER
MEASUREMENT PROCEDURE	ANSI 63.4 / 1992, TIA/EIA 603
PROCEDURE	CIRTIFICATION
FCC RULE	CFR 47 PART 90

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 90-Private Land Mobile Radio Service. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

Warning : This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Approved & Released For CCS By:

STEVE CHENG
MANAGER OF EMC DEPARTMENT
COMPLIANCE CERTIFICATION SERVICES

Test By:

THU CHAN
SENIOR EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The Expeditor is a fully programmable messaging system designed for the restaurant industry. The Expeditor can manage all communication traffic between the kitchen, servers, and guests. This system allows guests to send a specific request to the server just by pressing the button on their table unit. The chef unit feature enables the kitchen to page the server when an order is ready for pick up, saving the server unnecessary trips to the kitchen and insuring that the food is served fast and hot every time. The system keeps the service smooth and efficient, keeps the guest satisfied, and increases also table turnover.
The basic system comes with built-in UHF transmitter that provides a superior coverage area (approximately 5,000 to 7,000 square feet). It is composed of 50 individual table messaging units, 10 server's mobile units, one central processing unit, and one chef unit.

3. TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures documented on chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057.

4. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2))

6. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

7. APPLICABLE RULES AND BRIEF TEST RESULT

§90.205- POWER LIMIT

According to 90.205(g) 450–470 MHz. The maximum allowable station effective radiated power (ERP) is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 2. (I.e. 2W for service area less than 3 km.)

Table 2-450-470 MHz-Maximum ERP/Reference HAAT for a Specific Service Area Radius

	Service area radius (km)									
	3	8	13	16	24	32	40	48	64	80
Maximum ERP (w) [1].....	2	100	500	500	500	500	500	500	500	500
Up to reference HAAT (m) [3]....	15	15	15	27	63	125	250	410	950	2700

[1] Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCC Report R-6602, Fig. 29 (See Sec. 73.699, Fig. 10 b).

[3] When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation:

ERP allow $= ERP_{max} \times (HAAT_{ref} / HAAT_{actual})^2$.

Specification Limit: 2 Watts

§90.207- TYPE OF EMISSION

According to 90.207(e) for non-voice paging operations, only A1A, A1D, A2B, A2D, F1B, F1D, F2B, F2D, G1B, G1D, G2B, or G2D emissions will be authorized.

§90.209- BANDDWIDTH LIMITATION

According to 90.200(3) For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.

According to 90.200(5), unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following "STANDARD CHANNEL SPACING/BANDWIDTH" table.

Standard Channel Spacing/Bandwidth

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25		
25-50	20	20
72-76	20	20
150-174	[1] 7.5	[1,3] 20/11.25/6
220-222	5	4
421-512	[1] 6.25	[1,3] 20/11.25/6
806-821/851-866	25	20
821-824/866-869	12.5	20
896-901/935-940	12.5	13.6
902-928		
929-930	25	20
1427-1435		
2450-2483.52		
Above 2500		

1) For stations authorized on or after August 18, 1995.
3) Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized an 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth.

Specification Limit: 20KHz

§90.210- EMISSIONS MASKS

(c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter pursuant to Sec. 90.211(b), the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (f_d/5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (f_d^2 /11) dB or 50 dB, whichever is the lesser attenuation;

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

§90.213- FREQUENCY STABILITY

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have minimum frequency stability as specified in the following table.

Minimum Frequency Stability
[Parts per million (ppm)]

	Fixed and base stations	Mobile Stations	
		Over 2W output power	2 watts or less output power
Below 25	100	100	200
25-50	20	20	50
72-76	5	-------	50
150-174	5	5	50
220-222	0.1	1.5	1.5
421-512	2.5	5	[8]5
806-821	1.5	2.5	2.5
821-824	1.0	1.5	1.5
851-866	1.5	2.5	2.5
866-869	1.0	1.5	1.5
896-901	0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928	2.5	2.5	2.5
929-930	1.5	--------	--------
935-940	0.1	1.5	1.5
1427-1435	300	300	300
Above 2450	---------	----------	----------

[8]In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

Specification Limit: 1.5 ppm

§90.214- TRANSIENT FREQUENCY BEHAVIOR

Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time Intervals	Maximum Frequency Difference	All Equipment	
		150 to 174MHz	421 to 512MHz
Transient frequency Behavior for Equipment Designed to Operate on 25kHz Channels			
t_1[4]	±25.0kHz	5.0ms	10.0ms
t_2	±12.5kHz	20.0ms	25.0ms
t_3[4]	±25.0kHz	5.0ms	10.0ms
Transient frequency Behavior for Equipment Designed to Operate on 12.5kHz Channels			
t_1[4]	±12.5Hz	5.0ms	10.0ms
t_2	±6.25kHz	20.0ms	25.0ms
t_3[4]	±12.5kHz	5.0ms	10.0ms
Transient frequency Behavior for Equipment Designed to Operate on 6.25kHz Channels			
t_1[4]	±6.25Hz	5.0ms	10.0ms
t_2	±3.125kHz	20.0ms	25.0ms
t_3[4]	±6.25kHz	5.0ms	10.0ms

[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.
t_1 is the time period immediately following t_{on}
t_2 is the time period immediately following t_1
t_3 is the time period immediately before t_{off}

Specification Limit:

t_2= 25ms; during time interval t_2 the maximum frequency different = ±12.5 KHz

§2.1057- SPECTRUM RANGE TO BE INVESTIGATED

Lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the equipment operates at or above 10 GHz and below 30 GHz:
to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency.
Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§PART 15 RADIATED AND CONDUCTED EMISSION

The EUT is not a digital device as defined by §15.3 (k), therefore Part 15 requirements do not apply.

8. TEST SETUP, PROCEDURE AND RESULT

8.1. OUTPUT POWER & SPURIOUS EMISSIONS

INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	6/20/02
Amplifier	MITEQ	NSP2600-44	4/26/03
Signal Generator	Rohde & Schwarz	SMIQ 03	5/25/02
Bicon Antenna	Eaton	94455-1	3/30/03
LP Antenna	EMCO	3146	3/30/03
Tune Dipole	Compliance Design	Robert	5/5/03
Tx Horn Antenna	EMCO	3115	1/31/03
Rx Horn Antenna	EMCO	3115	1/31/03

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	☒ Peak ☐ Quasi Peak	☒ 100 KHz ☐ 120 KHz	☒ 100 KHz ☐ 120 KHz
Above 1000	☒ Peak ☐ Average	☒ 1 MHz ☐ 1 MHz	☒ 1 MHz ☐ 10 Hz

TEST SETUP

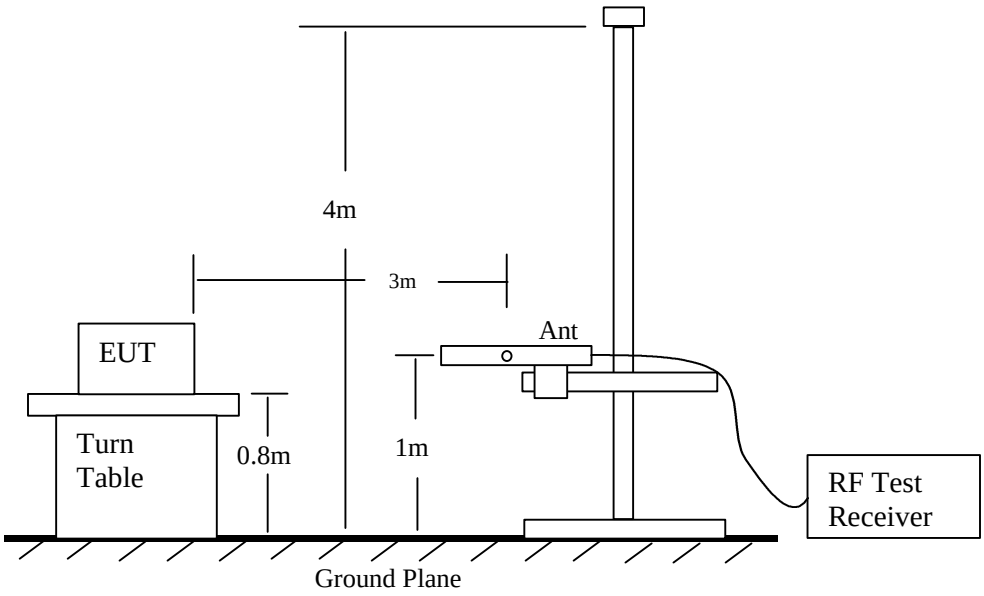


Fig 1: Radiated Emission Measurement (≤ 1GHz)

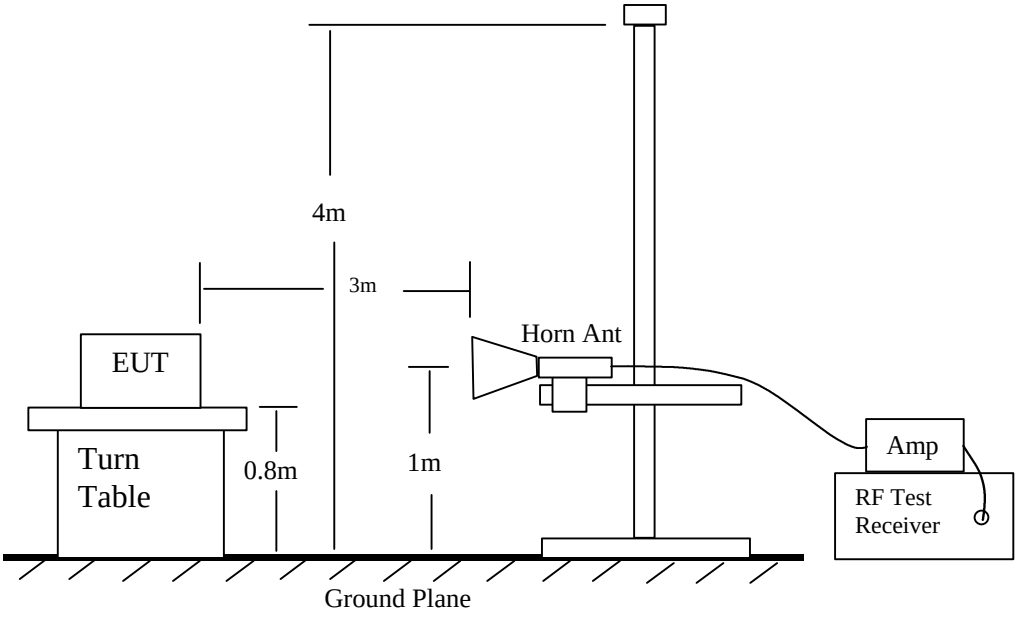


Fig 2: Radiated Emission Measurement (> 1GHz)

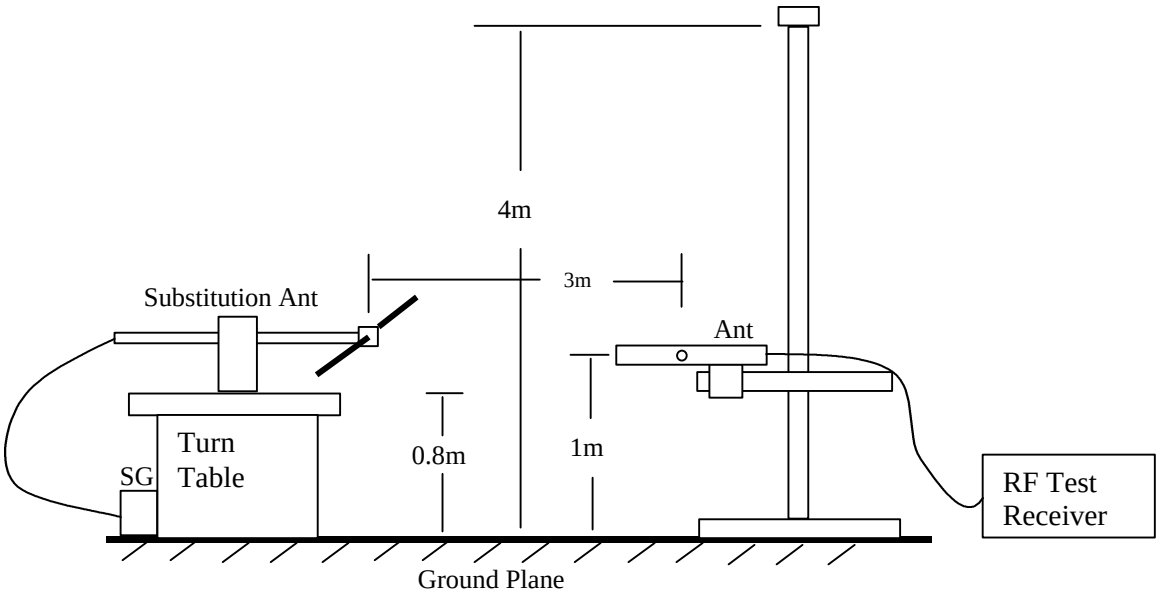


Fig 3: Substitution Method Set-up

TEST PROCEDURE

1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the frequency of the transmitter.
3). The output of the test antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
4). The transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
5). The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6). The transmitter shall than be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7). The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8). The maximum signal level detected by the measuring receiver shall be noted.
9). The transmitter shall be replaced by a substitution antenna (tuned dipole for f less than 1GHz and horn for frequency higher than 1GHz).
10). The substitution antenna shall be oriented for vertical polarization and the length (if a dipole antenna is used) of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11). The substitution antenna shall be connected to a calibrated signal generator.
12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
15). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
17). The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.
18). Repeat above substitution measurement procedure for fundamental and all harmonica emissions.

RESULT

As shown below:

Freq. (MHz)	SA Reading (dBuV)	SG Setting (dBm)	Ant Gain (dBi)	Dipole Gain (dBd)	Cable Loss (dB)	ERP Result (dBm)	Limit (dBm)	Margin (dBm)	Pol (H/V)
Fundamental measurement:									
457.58	96.66	21.00	0.00	0.00	0.50	20.50			3mV
457.58	93.00	17.50	0.00	0.00	0.50	17.00			3mH
Spurious & Harmonics:									
915.16	61.10	-23.80	0.00	0.00	0.80	-24.60	-13.00	-11.60	3mV
1372.74	59.70	-40.05	6.00	2.15	1.00	-37.20	-13.00	-24.20	3mV
1830.32	46.80	-53.75	6.50	2.15	1.20	-50.60	-13.00	-37.60	3mV
2287.90	32.10	-67.25	6.90	2.15	1.40	-63.90	-13.00	-50.90	3mV
2745.48	32.10	-66.55	7.80	2.15	1.60	-62.50	-13.00	-49.50	3mV
3203.06	35.70	-67.15	7.60	2.15	1.80	-63.50	-13.00	-50.50	3mV
3660.64	37.80	-64.90	7.85	2.15	2.00	-61.20	-13.00	-48.20	3mV
4118.22	29.90	-72.65	8.50	2.15	2.20	-68.50	-13.00	-55.50	3mV
4575.80	40.30	-61.05	10.00	2.15	2.40	-55.60	-13.00	-42.60	3mV
915.16	61.10	-20.70	0.00	0.00	0.80	-21.50	-13.00	-8.50	3mH
1372.74	59.70	-40.75	6.00	2.15	1.00	-37.90	-13.00	-24.90	3mH
1830.32	46.80	-53.35	6.50	2.15	1.20	-50.20	-13.00	-37.20	3mH
2287.90	32.10	-63.55	6.90	2.15	1.40	-60.20	-13.00	-47.20	3mH
2745.48	32.10	-65.85	7.80	2.15	1.60	-61.80	-13.00	-48.80	3mH
3203.06	35.70	-63.45	7.60	2.15	1.80	-59.80	-13.00	-46.80	3mH
3660.64	37.80	-61.30	7.85	2.15	2.00	-57.60	-13.00	-44.60	3mH
4118.22	29.90	-60.45	8.50	2.15	2.20	-56.30	-13.00	-43.30	3mH
4575.80	40.30	-60.75	10.00	2.15	2.40	-55.30	-13.00	-42.30	3mH
V.2c									

8.2. EMISSIONS MASKS

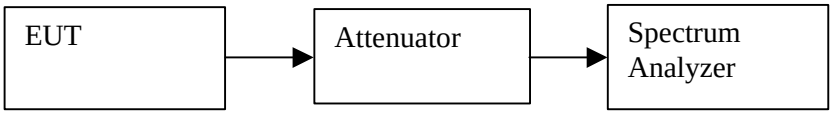
INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	6/20/02
Attenuator	MINI CIRCUITS	MCL BW-S20W2	NA

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	☒ Peak ☐ Quasi Peak	☒ 100 KHz ☐ 120 KHz	☒ 100 KHz ☐ 120 KHz
Above 1000	☒ Peak ☐ Average	☒ 1 MHz ☐ 1 MHz	☒ 1 MHz ☐ 10 Hz

TEST SETUP

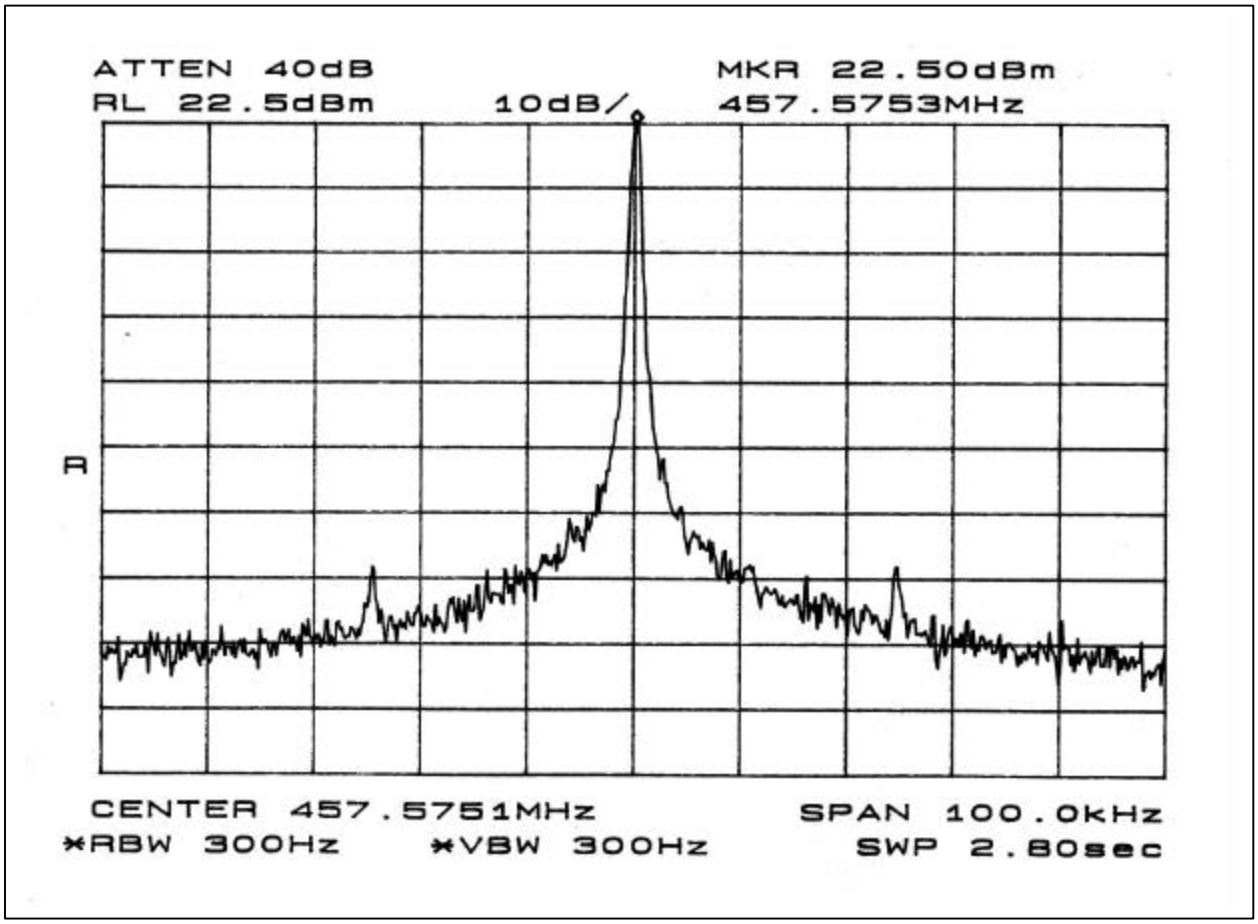


TEST PROCEDURE

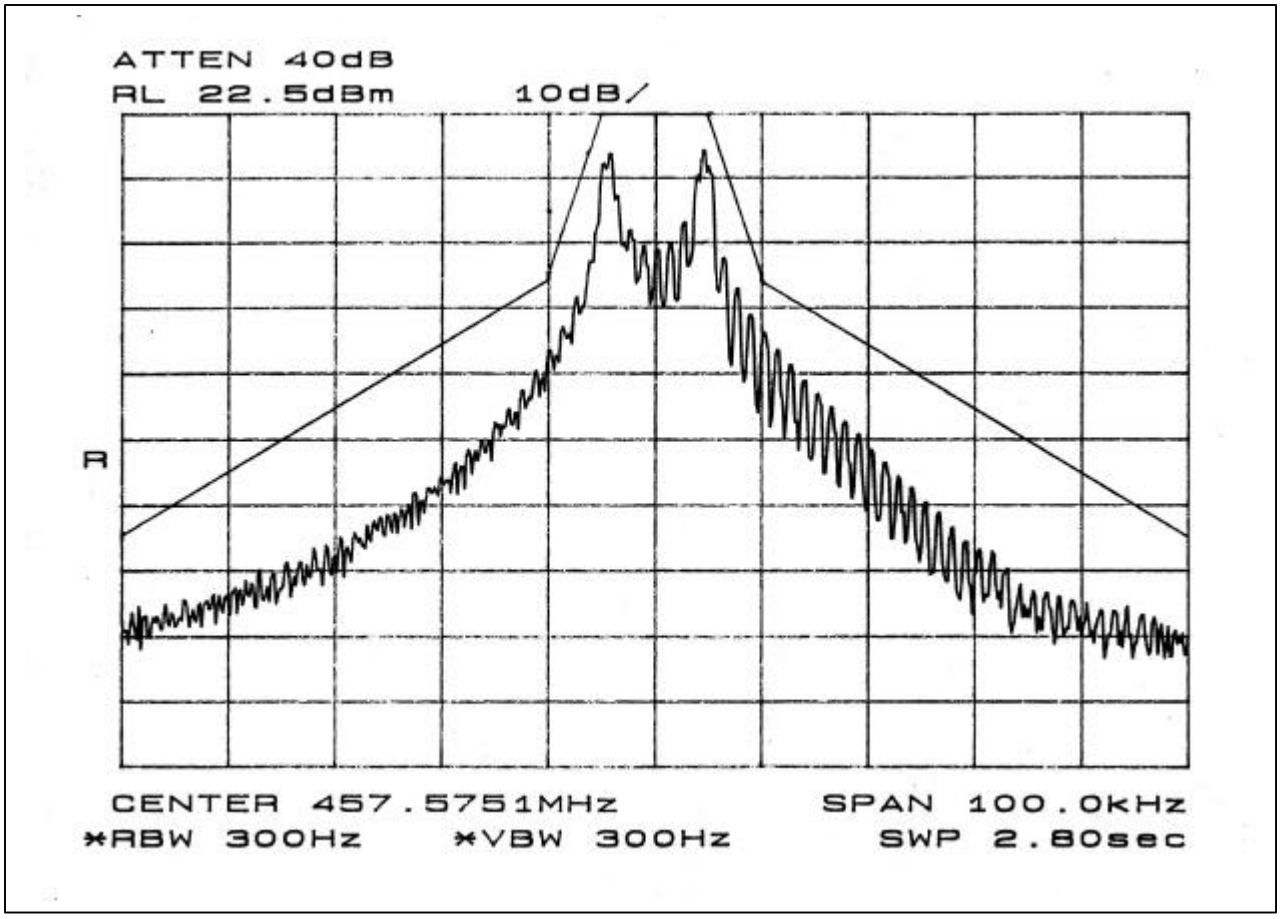
The EUT is configured on a test bench as shown above in a continuously transmitting / receiving mode. While the transceiver started, the analyzer MAX HOLD function was enabled and the frequency SPAN was adjusted to capture the whole emission.

RESULT

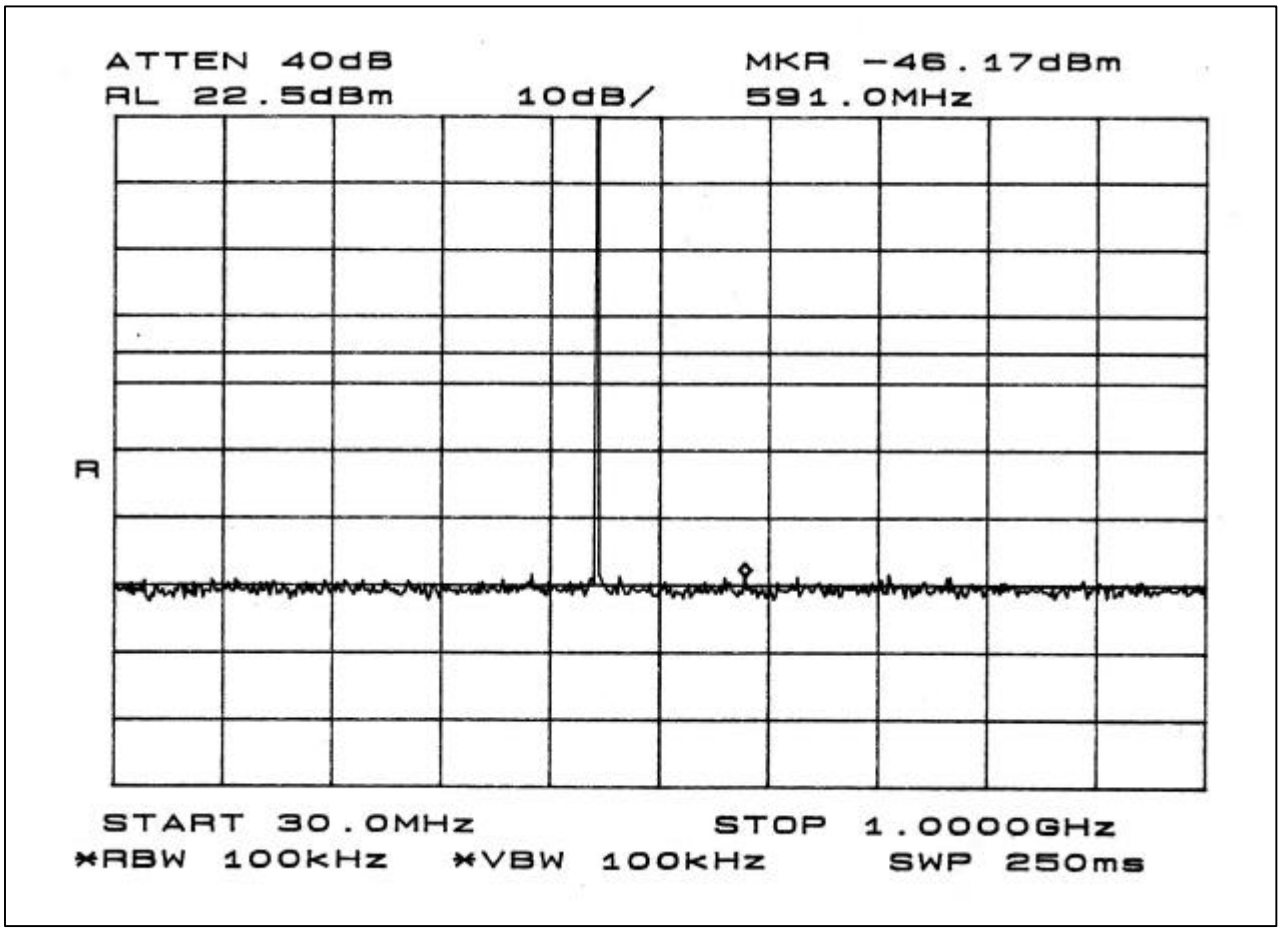
As shown below:

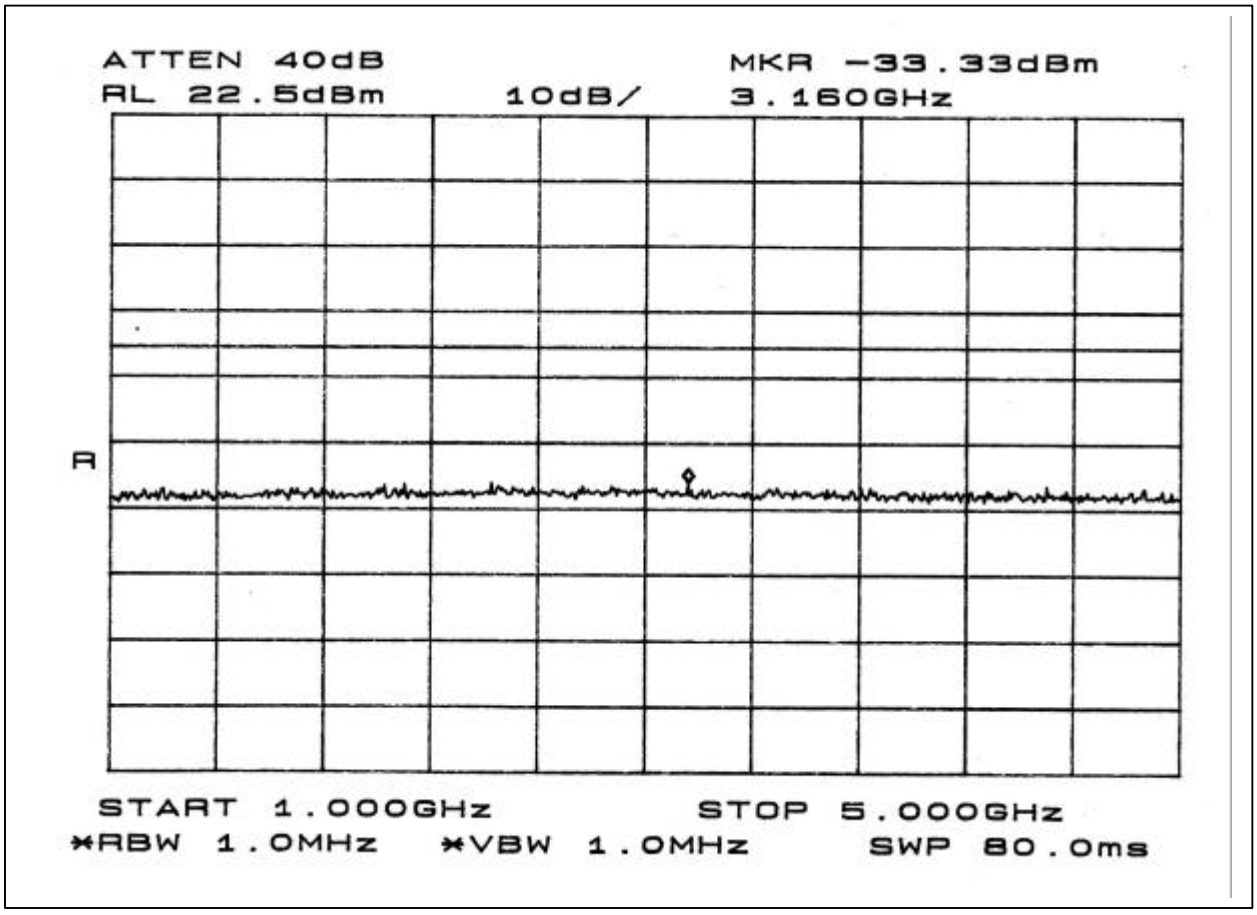


Un-Modulated Carrier Signal



OUT-OF-BAND Emissions





8.3. BANDWIDTH LIMITATION

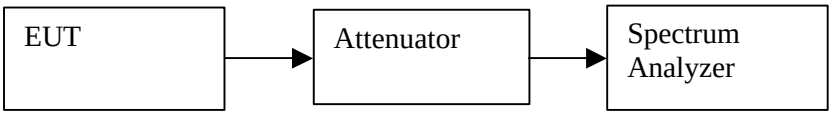
INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	05/25/01
Attenuator	MINI CIRCUITS	MCL BW-S20W2	NA

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	☒ Peak ☐ Quasi Peak	☒ 100 KHz ☐ 120 KHz	☒ 100 KHz ☐ 120 KHz
Above 1000	☒ Peak ☐ Average	☒ 1 MHz ☐ 1 MHz	☒ 1 MHz ☐ 10 Hz

TEST SETUP

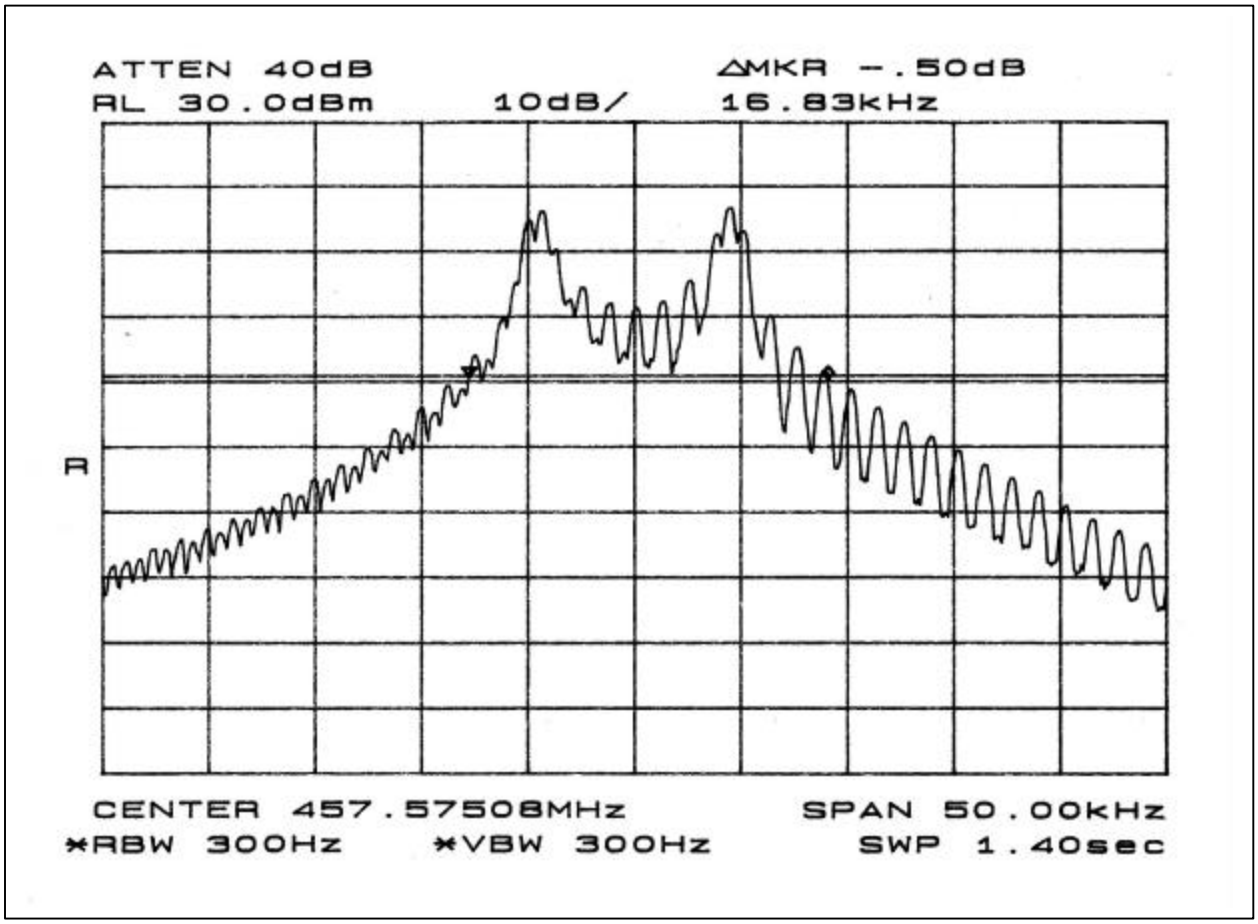


TEST PROCEDURE

The EUT is configured on a test bench as shown above in a continuously transmitting mode.
While the transceiver started, the analyzer MAX HOLD function was enabled and the frequency SPAN was adjusted to capture the whole emission.

RESULT

As shown below:



8.4. TRANSIENT FREQUENCY BEHAVIOR

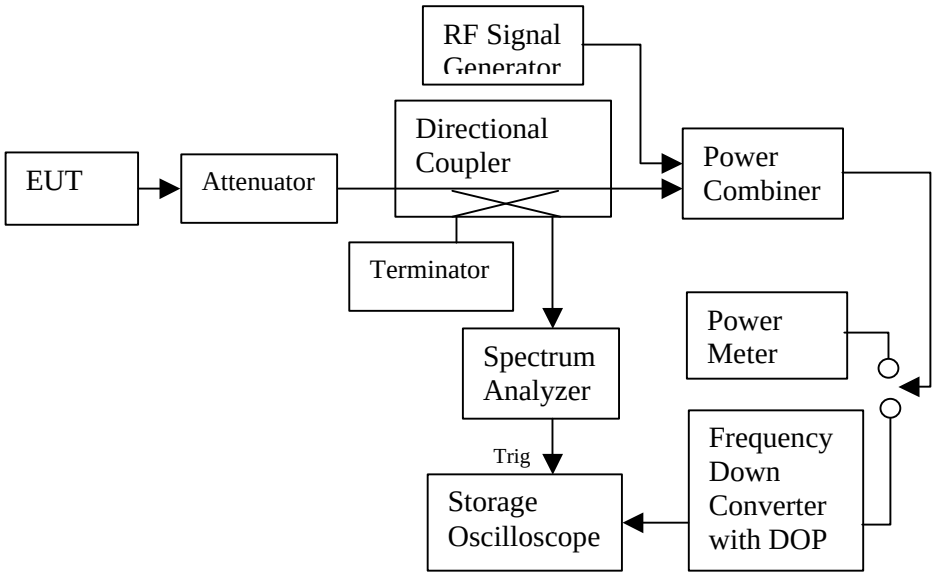
INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	06/20/03
Modulation Analyzer	HP	8901A	5/31/02
RF Synthesizer	HP	83732B	3/29/03
Storage Oscilloscope	Tektronix	11403/72/34	4/20/03
Power Meter	HP	436B	4/15/03
Directional Coupler	Werlatone	C6021	N.C.R
Power Combiner	N/A	N/A	N/A
Attenuator	N/A	N/A	N/A

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	☒ Peak ☐ Quasi Peak	☒ 100 KHz ☐ 120 KHz	☒ 100 KHz ☐ 120 KHz
Above 1000	☒ Peak ☐ Average	☒ 1 MHz ☐ 1 MHz	☒ 1 MHz ☐ 10 Hz

TEST SETUP



*p.s. Setup in according to TIA/EIA 603

TEST PROCEDURE

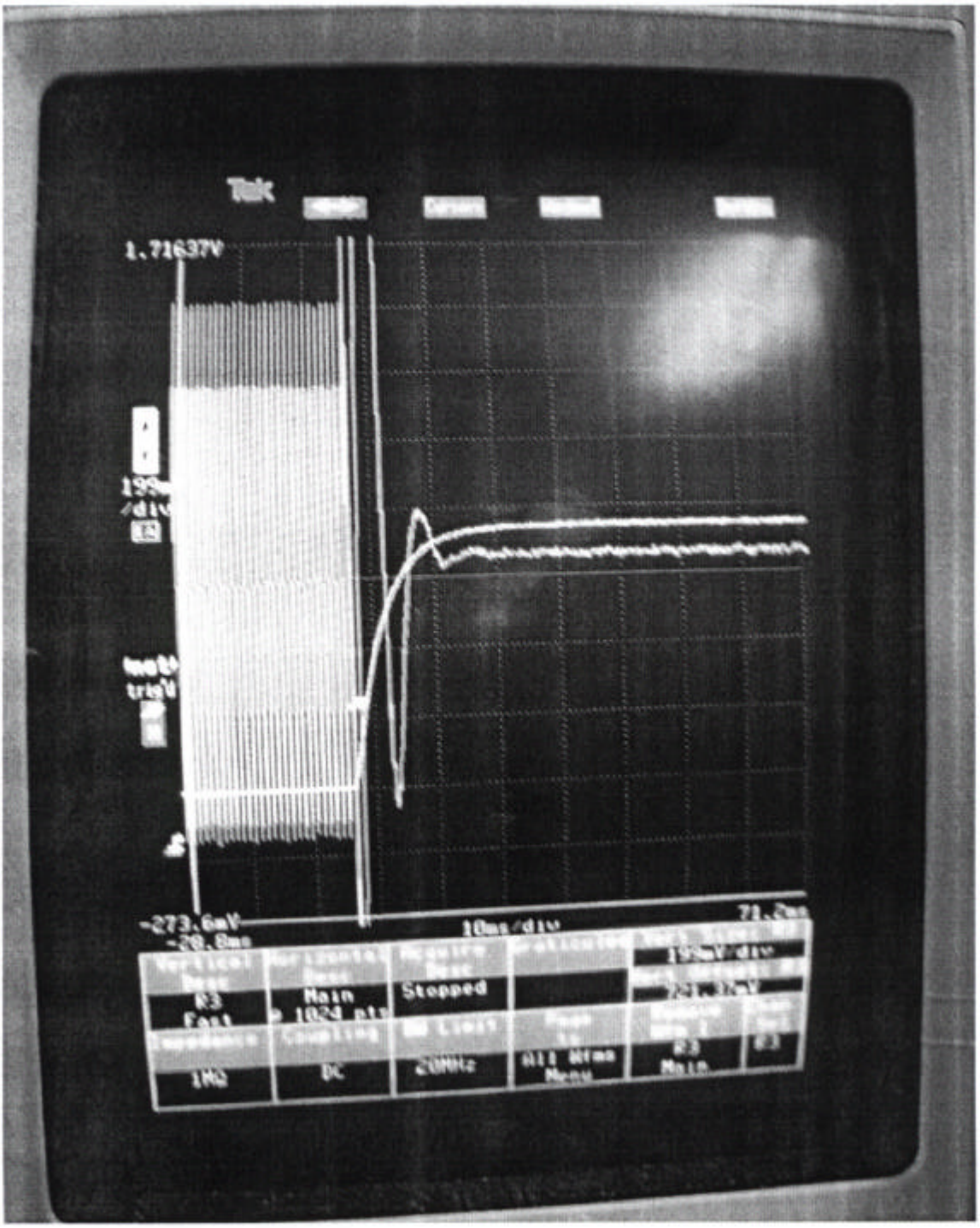
a) Connect the equipment as illustrated.
b) Connect the test receiver's Demodulator Output Port (DOP) to the vertical input channel of the storage oscilloscope. Connect the output of the RF peak detector to the external trigger on the storage oscilloscope. Connect the output of the RF combiner to the RF power meter.
c) Set the test receiver to measure FM deviation with the audio bandwidth set at ≤ 50 Hz to ≥15,000 Hz and tune the RF frequency to the transmitter assigned frequency.
d) Set the signal generator to the assigned transmitter frequency and modulated it with a 1 kHz tone at ±25 kHz deviation and set its output level to –100 dBm.
e) Turn the transmitter on.
f) Supply sufficient attenuation via the RF attenuator to provide an input level to the test receiver which is approximately 40 dB below the test receiver's maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on the RF power meter.
g) Turn the transmitter off.
h) Adjust the RF level of the signal generator to provide RF power into the RF power meter 20dB below the level noted in step f). This signal generator RF level shall be maintained throughout the rest of the measurement.
i) Disconnect the RF power meter and connect the output of the RF combiner network to the input of the test receiver.
j) Set the horizontal sweep rate on the storage oscilloscope to 10 milliseconds per division and adjust the display to continuously view the 1000 Hz tone from the DOP. Adjust the vertical amplitude control of the oscilloscope to display the 1000 Hz at ±4 divisions vertically centered on the display.
k) Adjust the oscilloscope so it will trigger on an increasing magnitude from the RF peak detector at 1 division from the left side of the display when the transmitter is turned on. Set the controls to store the display.
l) Reduce the attenuation of the RF attenuator so the input to the RF peak detector and the RF combiner is increased by 30 dB when the transmitter is turned on.
m) Turn on the transmitter and observe the stored display. The output at the DOP, due to the change in the ratio of power between the signal generator input power and the transmitter output power will, because of the capture effect of the test receiver, produce a change in display. For the first part of the sweep it will show the 1 kHz test signal. Then once the receiver's demodulator has been captured by the transmitter power, the display will show the frequency difference from the assigned frequency to the actual transmitter frequency versus time. The instant when the 1 kHz test signal is completely suppressed (including any capture time due phasing) is considered to be $t_{on.}$ The trace should be maintained within the allowed divisions during the period t_1 and t_2. See the figure in the appropriate standards section.
n) During the time from the end of t_2 to the beginning of t_3 the frequency difference should not exceed the limits set by the FCC in part 90.213 and outlined in the Carrier Frequency Stability sections. The allowed limit is equal to the transmitter frequency times its FCC frequency tolerance times ±4 display divisions divided by 25 kHz. For example, at a transmitter assigned frequency of 500 MHz and a frequency tolerance of 5 ppm. This would be 500 MHz times 5 ppm times ±4 divisions divided by 25 kHz. This equals ±0.4 divisions in this example. Greater vertical sensitivity may be required to view this accuracy.
o) Turn on the transmitter and observe the stored display. The trace should be maintained within the allowed divisions after the end of t_2 and remain within it until the end of the trace. See the figure in the appropriate standards sections.

p) To test t he transient frequency behavior during the period t_3, the transmitter shall be switched on.
q) Adjust the oscilloscope trigger controls so it will trigger on a decreasing magnitude from the RF peak detector, at 1 division from the right side of the display, when the transmitter is turned off. Set the controls to store the display. The moment when the 1 kHz test signal starts to rise is considered to provide $t_{off.}$
r) The transmitter shall be switched off.
s) Observe the display. The trace should remain within the allowed divisions during period $t_{3.}$ See the figures in the appropriate standards section.

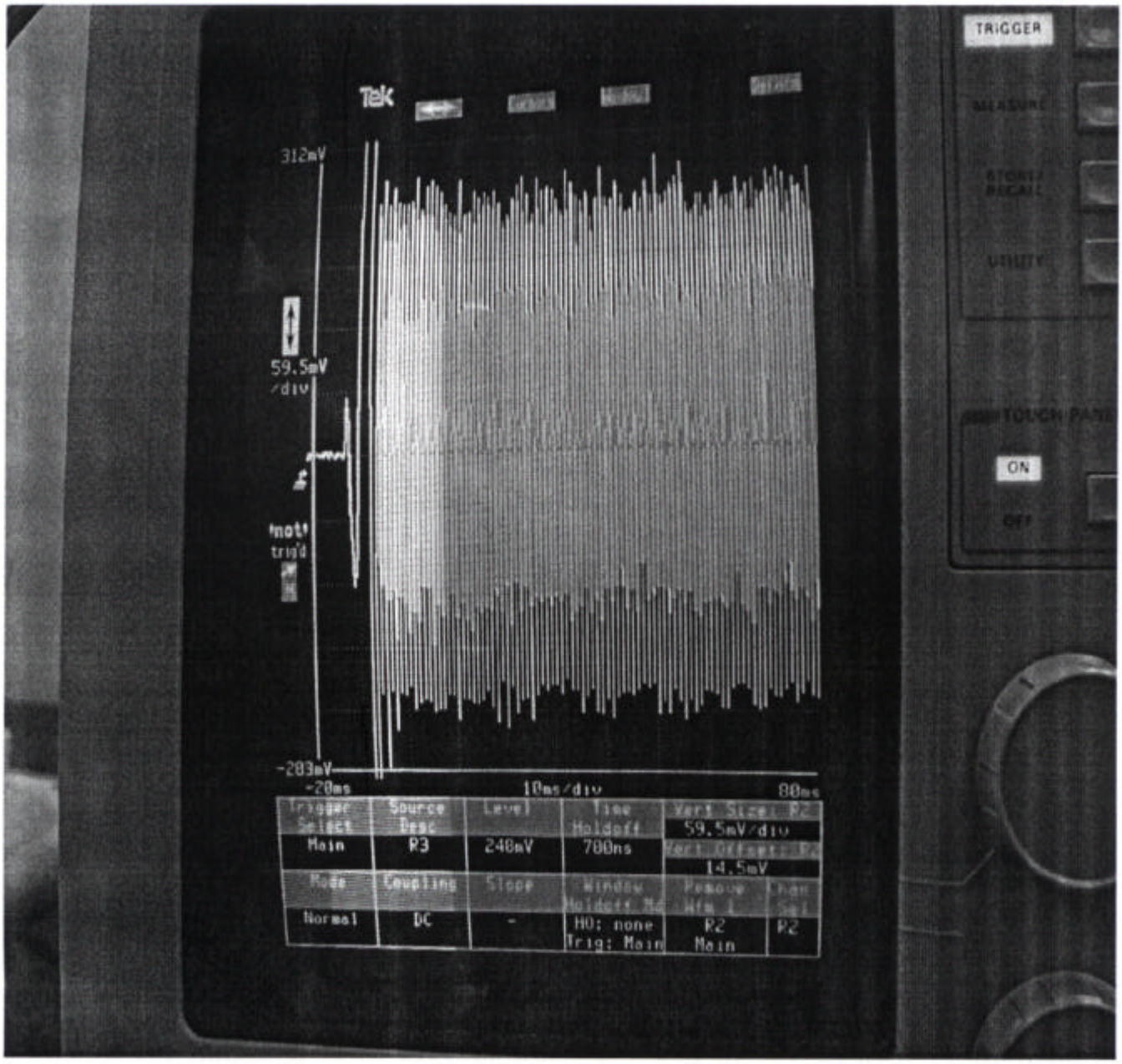
RESULT

As shown below:

EUT when turning ON



EUT when turning OFF



8.5. FREQUENCY STABILITY

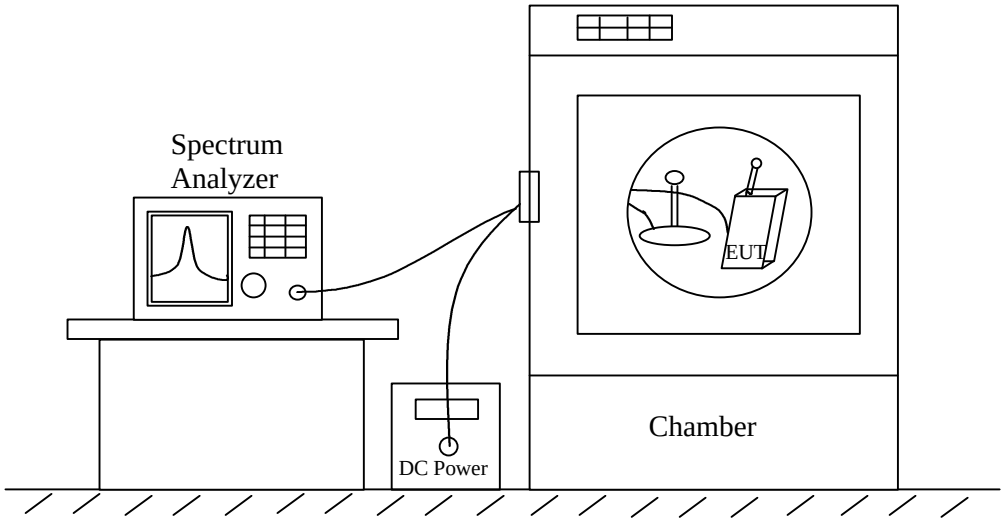
INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	06/20/02
Attenuator	MINI CIRCUITS	MCL BW-S20W2	NA
Environmental Chamber	TENNY	TEN	4/26/03

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	☒ Peak ☐ Quasi Peak	☒ 100 KHz ☐ 120 KHz	☒ 100 KHz ☐ 120 KHz
Above 1000	☒ Peak ☐ Average	☒ 1 MHz ☐ 1 MHz	☒ 1 MHz ☐ 10 Hz

TEST SETUP



TEST PROCEDURE

- **Frequency stability versus environmental temperature**

1). Setup the configuration per figure 6 for frequencies measurement inside the environmental chamber. Set the temperature of the chamber to 25°C and Install new batteries to the EUT if it is battery powered. Set SA Resolution Bandwidth low enough to obtain the desired frequency resolution and measure the EUT 25°C operating frequency as reference frequency.
2). Turn EUT off and set Chamber temperature to -30°C.
3). Allow sufficient time (approximately 20 to 30 minus after chamber reach the assigned temperature) for EUT to stabilize. Turn on EUT and measure the EUT operating frequency. Turn off EUT after the measurement.
4). Repeat step 3 with a 10°C increased per stage until the highest temperature of +50°C reached, record all measured frequencies on each temperature step.

- **Frequency stability versus DC input voltage**

1). Setup the configuration per figure 6 and set chamber temperature to 25°C. Use a variable DC power supply to power the EUT and set DC output voltage to EUT nominal input DC voltage. Set SA Resolution Bandwidth low enough to obtain the desired frequency resolution and measure the EUT 25°C operating frequency as reference frequency.
2). Slowly reduce the EUT input voltage to specified extreme voltage variation or battery-end-point voltage (if battery powered) and record the maximum frequency change.

RESULT

Complies, as shown below.

Frequency stability versus environmental temperature

Reference Frequencies: 20°C @ 457.575080 MHz Limit: to stay within ± 1.5 ppm (686Hz)			
Environment Temperature (°C)	Power Supplied (Vac)	Frequency deviation measured with time elapse	
		Hz	ppm
50	Fixed 115Vac	-346	-0.8
40	Fixed 115Vac	-325	-0.7
30	Fixed 115Vac	-262	-0.6
20	Fixed 115Vac	0	0
10	Fixed 115Vac	258	0.6
0	Fixed 115Vac	453	1.0
-10	Fixed 115Vac	592	1.3
-20	Fixed 115Vac	411	0.9
-30	Fixed 115Vac	481	1.1

Frequency stability versus input voltage

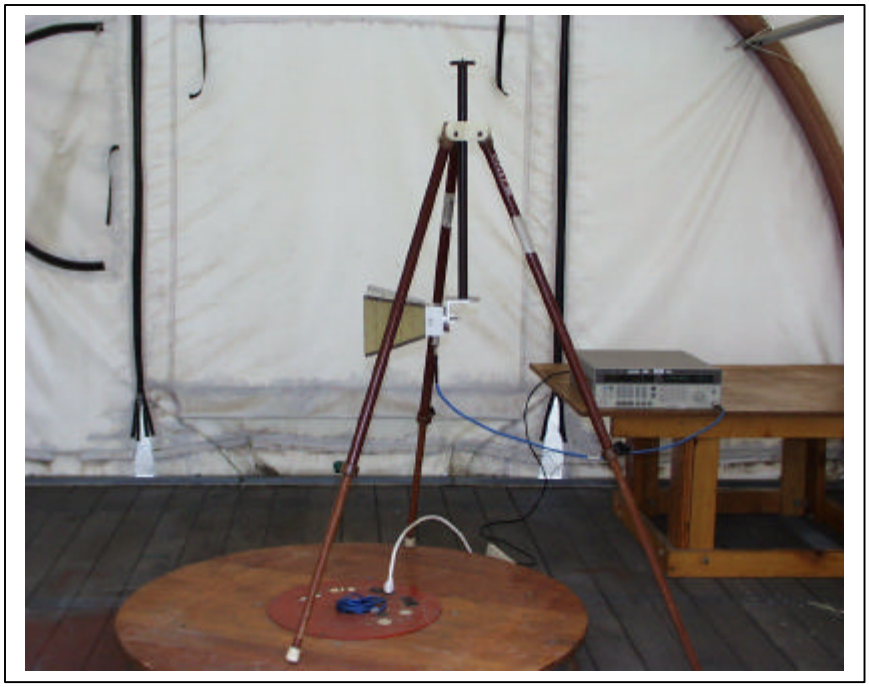
Type:

Reference Frequency: 457.575080MHz @115Vac			Limit: 1.5 ppm (686Hz)
Environment Temperature (°C)	Power Supplied (Vdc/Vac)	Frequency deviation measured with time elapse	
		Hz	ppm
20	97.8	2	0
20	132.3	1	0

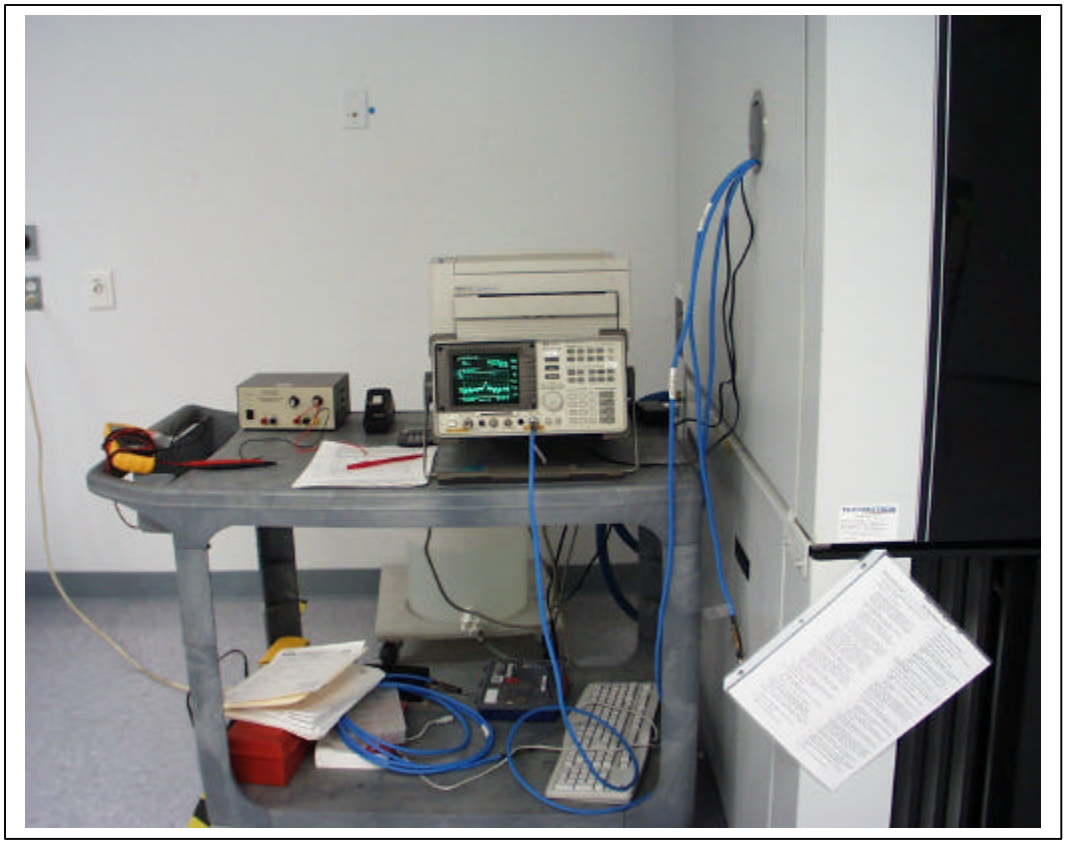
8.6. SETUP PHOTOS

Conducted Measurement

Fundamental & Spurious Emissions Measurements



Substitution Measurements



Frequency Stability Versus Temperature or Input Voltage

END OF REPORT